MINISTRY OF EDUCATION, SINGAPORE
in collaboration with
CAMBRIDGE ASSESSMENT INTERNATIONAL EDUCATION
General Certificate of Education Ordinary Level

Paper 1 Multiple Choice

October/November 2020

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, Centre number and index number on the Answer Sheet in the spaces provided unless this has been done for you.
DO **NOT** WRITE ON ANY BARCODES.

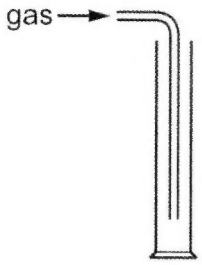
There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

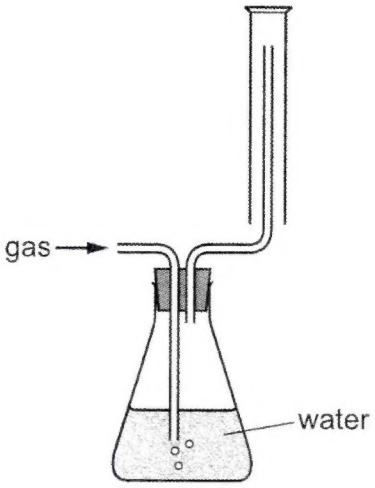
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
A copy of the Data Sheet is printed on page 19.
A copy of the Periodic Table is printed on page 20.
The use of an approved scientific calculator is expected, where appropriate.

20 Which apparatus is used to collect a gas that is soluble in water and less dense than air?

A



B



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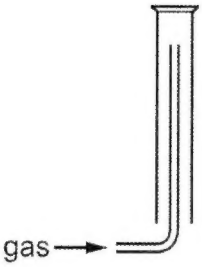

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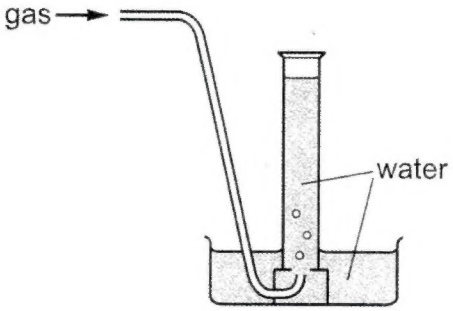


21 Which method is used to obtain potassium chloride crystals from an aqueous solution of potassium chloride?

A evaporation

B filtration

C fractional distillation

D paper chromatography

22 A solution of compound W is tested with different reagents.

The results are shown.

reagent	observation
aqueous ammonia	no visible change
dilute nitric acid and aqueous silver nitrate	no visible change
dilute nitric acid and aqueous barium nitrate	white precipitate
aqueous sodium hydroxide	white precipitate-insoluble in excess

What is W?

A calcium chloride

B calcium sulfate

C zinc chloride

D zinc sulfate

23 Which statement about isotopes of the same element is correct?

A They have different numbers of electrons but the same number of protons.

B They have different numbers of electron shells but the same number of neutrons.

C They have different numbers of neutrons but the same number of electron shells.

D They have different numbers of protons but the same number of electrons.

24 Element A is a metal and element B is a non-metal.

Which statement is correct?

A The compound of A and B has covalent bonds and a high melting point.

B The compound of A and B has covalent bonds and a low melting point.

C The compound of A and B has ionic bonds and a high melting point.

D The compound of A and B has ionic bonds and a low melting point.

25 Element X has the electronic configuration 2,4.

Element Y has the electronic configuration 2,6.

What is the formula of the compound formed between X and Y?

A XY_2 **B** X_2Y **C** X_2Y_3 **D** X_3Y_2

26 Calcium phosphate has the formula, $Ca_3(PO_4)_2$.

What is the charge on the phosphate ion?

A 2– **B** 3– **C** 2+ **D** 3+

27 Glucose has a relative molecular mass, M_r, of 180.

How many grams of glucose are added to $50\,cm^3$ of water to make a solution of concentration $0.4\,mol/dm^3$?

A 3.6 **B** 9 **C** 36 **D** 72

28 Dissolving ammonium nitrate in water is an endothermic process.

Which row shows the direction of heat flow and the change in temperature when ammonium nitrate dissolves in water?

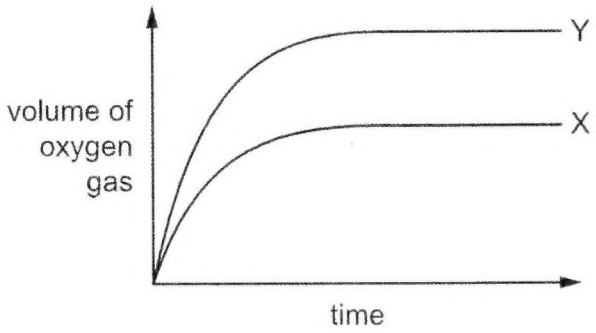
	temperature change	direction of heat flow
A	rise	to surroundings
B	fall	to surroundings
C	rise	from surroundings
D	fall	from surroundings

29 Hydrogen peroxide (H_2O_2) decomposes (breaks down) to form water and oxygen gas.

$$2H_2O_2 \rightarrow 2H_2O + O_2$$

When lumps of manganese(IV) oxide (a catalyst) are added to a solution of hydrogen peroxide, the speed of decomposition of hydrogen peroxide is increased.

The volume of oxygen gas produced by the decomposition of hydrogen peroxide over time is measured. The results are shown as line X on the graph.



Which change in conditions produces line Y?

A increasing the temperature

B using half the volume of the same concentration of hydrogen peroxide

C using powdered manganese(IV) oxide

D using the same volume of more concentrated hydrogen peroxide

30 Aqueous iron(III) chloride reacts with aqueous potassium iodide to produce a brown solution.

Aqueous iron(II) chloride reacts with acidified potassium manganate(VII) to produce a yellow/pale orange solution.

What is the role of iron(III) chloride and iron(II) chloride in these reactions?

	iron(III) chloride	iron(II) chloride
A	oxidising agent	oxidising agent
B	oxidising agent	reducing agent
C	reducing agent	oxidising agent
D	reducing agent	reducing agent

31 Which row about the reactions of an acid is correct?

	products with a reactive metal	products with a carbonate
A	a salt and hydrogen	a salt, water and hydrogen
B	a salt and hydrogen	a salt, water and carbon dioxide
C	a salt and water	a salt, water and carbon dioxide
D	a salt and water	a salt, water and hydrogen

32 An unknown metal oxide, XO, is an insoluble solid.

XO is an amphoteric oxide.

Which row is correct?

	effect of adding universal indicator to solid XO	reaction of XO with sodium hydroxide	reaction of XO with hydrochloric acid
A	no change	✓	✓
B	no change	✗	✗
C	turns blue	✓	✓
D	turns blue	✗	✓

33 R and T are elements in Group I of the Periodic Table.

R has a melting point of 98 °C.

T has a melting point of 63 °C.

Which statement is correct?

A R has less electron shells than T.

B R has less outer shell electrons than T.

C R has more protons than T.

D R is more reactive than T.

34 Three metals, X, Y and Z, were heated separately with the oxides of four metals P, Q, R and S, to find the order of reactivity.

The results are shown in the table.

metal	metal oxide				key
	P	Q	R	S	
X	✗	✗	✗	✗	✓ = reaction observed
Y	✓	✓	✗	✓	✗ = no reaction observed
Z	✗	✓	✗	✗	

What is the order of the reactivity of the metals from the least reactive to the most reactive?

A X → Z → Y

B Y → X → Z

C Y → Z → X

D Z → Y → X

35 The blast furnace is used for the extraction of iron from its ore.

Which substance is used to remove impurities in the ore?

A air

B coke

C haematite

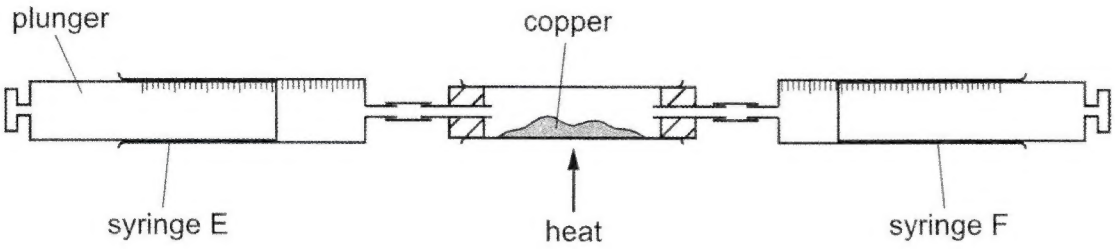
D limestone

36 Heated copper reacts with oxygen to produce copper(II) oxide.

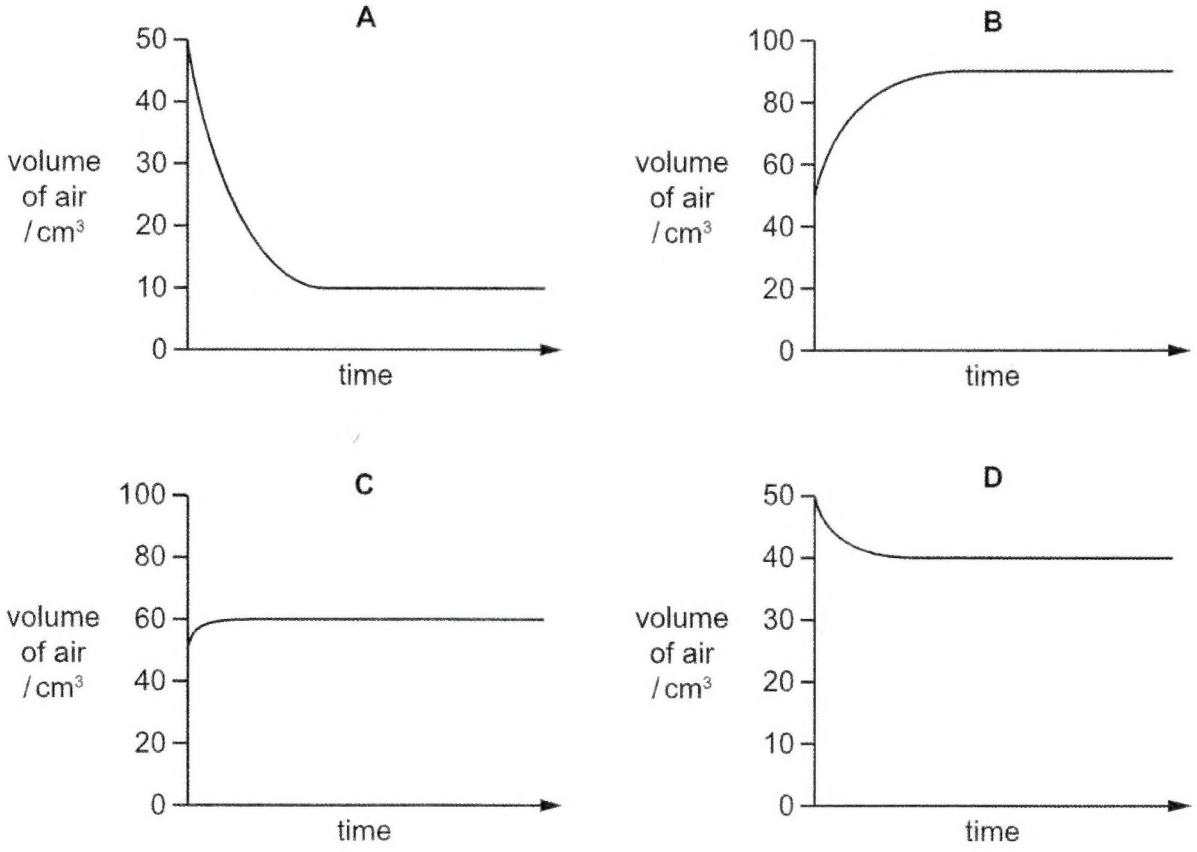
The percentage of oxygen in air can be found by passing air over heated copper, in the apparatus shown.

The plungers are alternately pushed so that air passes over the hot copper.

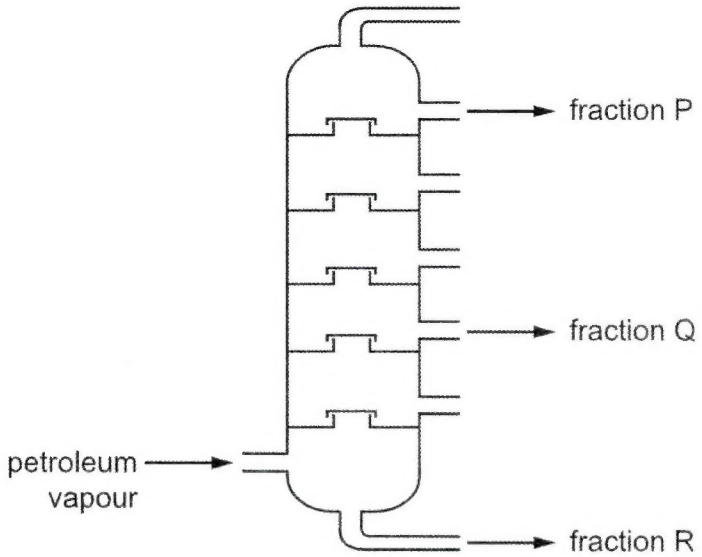
The original volume of air is 50 cm^3.



Which graph shows how the volume of air changes during the experiment?



38 The diagram shows a fractionating tower in which petroleum is separated into fractions.



What are fractions P, Q and R?

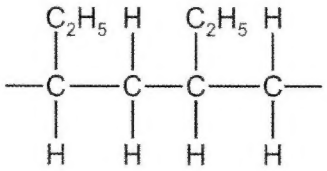
	P	Q	R
A	diesel	bitumen	petrol (gasoline)
B	diesel	petrol (gasoline)	bitumen
C	petrol (gasoline)	bitumen	diesel
D	petrol (gasoline)	diesel	bitumen

39 Chlorine gas reacts with methane under certain conditions.

Which row describes the conditions required and the type of reaction?

	conditions	type of reaction
A	in the dark	addition
B	in the dark	substitution
C	in ultraviolet light	addition
D	in ultraviolet light	substitution

40 The diagram shows part of the structure of an addition polymer.



What is the formula of the monomer used to make the polymer?

A C_2H_4 **B** C_4H_8 **C** C_4H_{10} **D** C_8H_{16}

20. (C)

Since the gas is soluble in water, any method that involves bubbling the gas through water is not suitable.

Since the gas is less dense than air, it can be collected by the upward delivery method.

EXAM TIP:

Displacement method is used to collect gases which are not very soluble in water. Upward delivery is used to collect gases which are less dense than air.

21. (A)

Evaporation (or crystallisation) is used to obtain crystals from a solution.

EXAM TIP:

Crystals are obtained from evaporation of solution.

22. (B)

Since the solution gives a white precipitate when tested with barium nitrate, compound W contains sulfate ions.

When tested with aqueous sodium hydroxide, a white precipitate is formed which is insoluble in excess sodium hydroxide, thus compound W contains calcium ions.

EXAM TIP:

Identify the ions that when added to barium sulfate and sodium hydroxide solutions, form white precipitate.

23. (C)

Isotopes have different numbers of neutrons, but the same number of protons and electrons (i.e. same number of electron shells).

EXAM TIP:

Isotopes are atoms of the same element that have the same number of protons but different numbers of neutrons.

24. (C)

EXAM TIP:

Metal and non-metals combine to form ionic compounds, which generally have high melting and boiling points.

25. (A)

The number of valence electrons of elements X and Y are 4 and 6 respectively. Thus, they are likely to form covalent bonds by sharing electrons.

Four electrons are shared between each atom of element Y and an atom of element X to attain a noble gas electronic configuration. Hence, the formula of the compound formed between X and Y is XY_2.

EXAM TIP:

Elements form compounds to attain a noble gas electronic configuration.

26. (B)

Since the chemical formula of calcium phosphate is $Ca_3(PO_4)_2$ and calcium ion has a charge of 2+, the charge of phosphate ion is 3–.

EXAM TIP:

The sum of all charges in a compound is 0.

27. (A)

Number of moles of glucose in 50 cm^3 solution

$$= 0.4 \times \frac{50}{1000}$$

$$= 0.02 \text{ mol}$$

Mass of glucose added $= 0.02 \times 180$

$$= 3.6 \text{ g}$$

EXAM TIP:

Number of moles = Concentration × Volume
Mass = Number of moles × Molar mass

28. (D)

EXAM TIP:

In an endothermic reaction, heat is absorbed from the surroundings, thereby causing the temperature of the surroundings to fall.

29. (D)

From the graph, line Y shows a greater volume of oxygen gas evolved compared to line X, indicating that the amount of reactants in reaction Y is greater than in X.

An increase in concentration of hydrogen peroxide increases the amount of hydrogen peroxide in the reaction, hence (D) is correct.

EXAM TIP:

Greater amounts of reactants result in greater amounts of products produced.

30. (B)

Potassium iodide is oxidised by iron(III) chloride to form iodine. Therefore, iron(III) chloride acts as an oxidising agent.

Potassium manganate(VII) is reduced by iron(II) chloride to form Mn^{2+}. Therefore, iron(II) chloride acts as a reducing agent.

EXAM TIP:

Oxidising agents oxidise other substances, while reducing agents reduce other substances.

31. (B)

EXAM TIP:

Acids react with metals to form salt and hydrogen.
Acids react with carbonates to form salt, water and carbon dioxide.

32. (A)
Since XO is an insoluble solid, the universal indicator remains unchanged.
An amphoteric oxide can react with both acids and bases, thus can react with both hydrochloric acid (an acid) and sodium hydroxide (a base).

EXAM TIP:
An amphoteric oxide reacts with both acids and alkalis.

33. (A)
Down Group I, the melting point of elements decreases, thus R is positioned higher in the Periodic Table than T. Therefore, R has less electron shells than T.

EXAM TIP:
Down Group I, the melting point of elements decreases and reactivity increases.

34. (A)
Since Y can react with P, Q and S, it is the most reactive metal.
Since X cannot react with any of the metal oxides, it is the least reactive metal.

EXAM TIP:
A more reactive metal displaces a less reactive metal from its oxide.

35. (D)
Limestone decomposes to give calcium oxide, which is used to remove SiO_2 impurities.
$CaCO_3 \rightarrow CaO + CO_2$
$CaO + SiO_2 \rightarrow CaSiO_3$

EXAM TIP:
In the extraction of iron from its ore, limestone is added to remove impurities such as SiO_2.

36. (D)
Oxygen reacts with copper to form copper oxide. Since air consists of approximately 20% oxygen, the volume of air decreases from 50 cm^3 to 40 cm^3.

EXAM TIP:
The volume composition of gases present in dry air is approximately 78% nitrogen, 21% oxygen and the remainder (approximately 1%) comprises noble gases (with argon as the main constituent) and carbon dioxide.

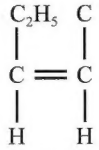
38. (D)
Petrol (gasoline) has the lowest boiling point, followed by diesel, and then bitumen.

EXAM TIP:
Petroleum is separated into useful fractions by fractional distillation.

39. (D)
Methane undergoes substitution reaction with chlorine gas in ultraviolet light.

EXAM TIP:
Alkanes undergo substitution reactions only.

40. (B)
The chemical structure of the monomer is:



EXAM TIP:
Identify the repeat unit from the given part of the structure.

October/November 2020 Paper 3

Section A

1.

description of process	name of process
separating a precipitate from a solution	*filtering*
cooling a vapour into a liquid	**condensation**
mixing equal amounts of strong acid and strong alkali	**neutralisation**
changing long-chain hydrocarbons into short-chain hydrocarbons	**cracking**
joining together thousands of small, identical molecules to form huge molecules	**polymerisation**

EXAM TIP:
- The process where a substance undergoes a change from gaseous state to liquid state is called condensation.
- Neutralisation is a reaction in which an acid and a base react to form a salt and water.
- Large hydrocarbons can be broken down into smaller molecules through cracking.
- Polymerisation is the process of joining together a large number of small, identical molecules (monomers) to form huge molecules.

2. **(a)** alloy: steel
constituent 1: iron
constituent 2: carbon

EXAM TIP:
Recall examples of alloys and their constituents.

(b) **(i)**